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Pesticide Fact Sheet Number 169: Fenthion

(U.S.) Environmental Protection Agency
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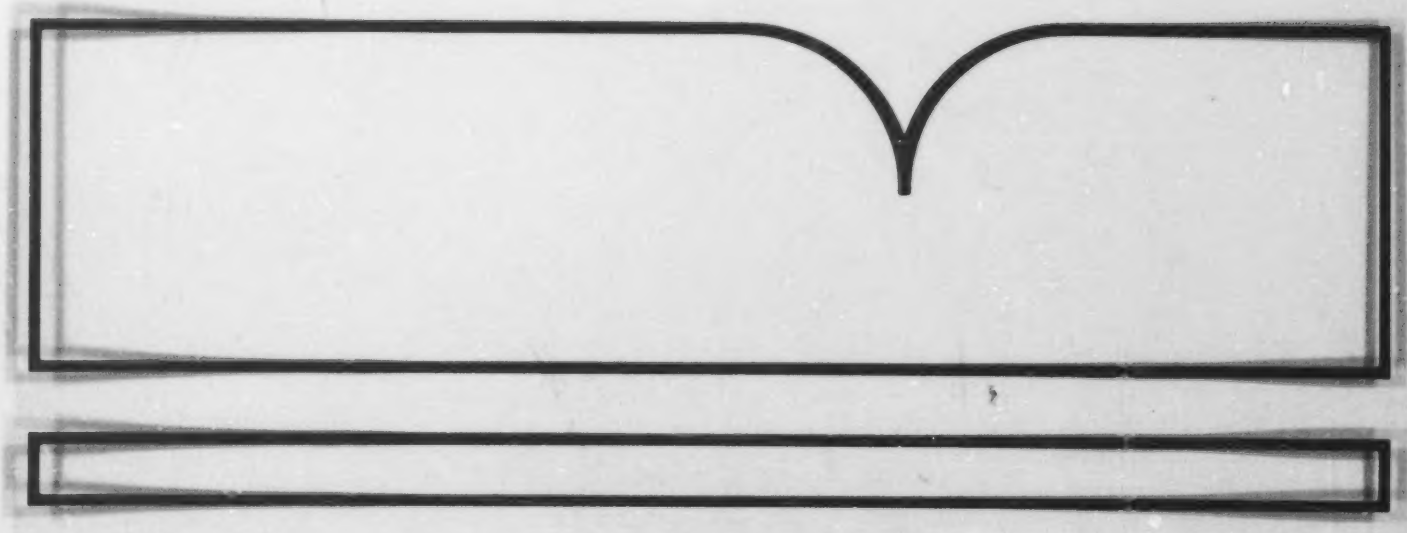

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16. Abstract (Limit: 200 words)

This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the the following actions has occurred.

1. Issuance or reissuance of a registration standard,
2. Issuance of each special review document,
3. Registration of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

17. Document Analysis a. Descriptors

Pesticides, regulations, Chemical Information Fact Sheet, Use Patterns, science findings.

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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Washington, DC 20460

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EPA

Pesticide Fact Sheet

Name of Chemical: Fenthion
Reason for Issuance: Issuance of Registration Standard
Date Issued: June 30, 1988
Fact Sheet Number: 169

1. DESCRIPTION OF CHEMICAL

Generic Name: O,O-dimethyl-O-[4-(methylthio)-m-tolyl] phosphorothioate (Chemical)

Other Chemical Names: O,O-dimethyl-O-[3-methyl-4-(methylthio)phenyl phosphorothioate
O,O-dimethyl-O-4-methylthio-m-tolyl phosphorothioate

Common Name: Fenthion (FDA), No American National Standards Institute Common Name

Trade and Other Names: Baytex; Entex; Bayer 29493; Bayer S-1752; Baycid; Lebaycid; Spotton; Tiguvon; Mercaptophos

EPA Chemical Code: 053301

Chemical Abstracts Service (CAS) Number: 55-38-9

Year of Initial Registration: 1965

Pesticide Type: Insecticide/Acaricide, Avicide, Mosquitocide (adults and larvae)

Chemical Family: Organophosphate

U.S. and Foreign Producers: Mobay Chemical Corp. (United States); and Bayer AG (Federal Republic of Germany)

2. PHYSICAL AND CHEMICAL CHARACTERISTICS

Chemical Characteristics of the Technical Material[1]

Physical State: Liquid.

Color: Yellow-tan.

Odor: Slight garlic odor.

Molecular Weight and Formula: 278.3 - $C_{10}H_{15}O_3PS_2$.

Melting Point: <-25°C

Boiling Point: 105°C at 0.01 mm Hg.

Vapor Pressure: 3×10^{-5} mm Hg at 20°C.

Density: 1.250 at 20°C.

Solubility in various solvents: Practically insoluble in water (55 mg/l), soluble in methanol, ethanol, ether, acetone, and many other organic solvents (especially chlorinated hydrocarbons).

Physiological and Biochemical Characteristics

Mechanism of Pesticidal Action: Cholinesterase inhibition following ingestion of fenthion or dermal absorption from contact with treated surfaces.

Metabolism and Persistence in Plants and Animals: The metabolism of fenthion in plants and animals is not adequately understood. The available plant metabolism data indicate that the following metabolites were found in the leaves of cotton plants treated with fenthion: fenthion oxygen analog, fenthion oxygen analog sulfoxide, fenthion oxygen analog sulfone, dimethyl phosphorothioic acid and dimethyl phosphoric acid. Fenthion sulfoxide, fenthion sulfone, fenthion oxygen analog sulfoxide, and fenthion oxygen analog sulfone were the metabolites detected in fenthion treated bean plants. The available animal metabolism data indicate that the metabolites fenthion

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[1]The physical/chemical properties of fenthion listed in this section were obtained from Merck Index 10th Edition.

sulfoxide and fenthion oxygen analog identified as one entity, and fenthion sulfone, fenthion oxygen analog sulfoxide, and fenthion oxygen analog sulfone identified as another single entity were tentatively identified in steak, liver, milk, urine, and feces from cattle. Dimethyl phosphoric acid and dimethyl thiolophosphoric acid were also tentatively identified in urine from cattle. The metabolites fenthion sulfoxide, fenthion sulfone, fenthion oxygen analog, fenthion oxygen analog sulfoxide and fenthion oxygen analog sulfone were identified in muscle, heart, fat, kidney, and liver from swine. Swine liver was also found to contain the additional metabolites fenthion sulfoxide phenol and fenthion sulfone phenol while in swine kidney the additional metabolites detected in swine liver plus the metabolite fenthion phenol. All of the metabolites found in swine tissues were individually identified.

3. USE PATTERNS AND FORMULATIONS

Application Sites: Mosquito and insect control on swamps, standing water, recreation areas, alfalfa, pasture grass, forests, barns, poultry houses, nonfood/feed areas of restaurants and commercial buildings, and homes; lice control on cattle (beef and non-lactating dairy) and hogs; control of ants, mites, leafhoppers, and aphids on ornamentals and flowers; bird control; rice to control mosquitoes (in the State of California only).

Types and Methods of Application: Ground application is used for all uses of fenthion. Both ground and aerial applications are used to control mosquitoes with control measures being directed to both the aquatic (larval/pupal) stages and the free-flying adult stage.

Types of Formulations: Dust, emulsifiable concentrates, soluble concentrate/liquid, granular, and liquid-ready to use.

4. SCIENCE FINDINGS

Summary Science Statement

--Fenthion is moderately toxic (Toxicity Category II) by the oral, dermal and inhalation routes of exposure.

--Fenthion is minimally irritating (Toxicity Category IV) to the skin and eyes.

--Fenthion is not teratogenic in rabbits, and does not denonstrate mutagenic effects. Other subchronic and chronic effects, such as oncogenicity and reproductive effects, are not characterized at this time because of lack of data.

--There are insufficient data to fully assess the environmental fate of fenthion.

--Preliminary data indicate that fenthion degrades in soil rapidly, having a half life of less than one day. Other environmental fate characteristics are undefined, including fenthion's ability to contaminate ground water.

--There are insufficient data to characterize the acceptable dietary exposure to fenthion.

--Fenthion is highly toxic to aquatic organisms, birds, and honey bees. However, field kills of fish and birds have not been documented.

--Fenthion is likely to jeopardize endangered species when used as a mosquito larvicide.

Toxicology Characteristics

--Except for mutagenicity studies, acute oral, dermal, and inhalation studies, acute dermal and eye irritation studies, and a rabbit teratology study, the Agency has no acceptable toxicology studies for fenthion.

--The acute oral LD^{50} for rats is ~250 mg/kg (males) and ~295 mg/kg (females).

--The acute dermal LD^{50} for rats is 1680 mg/kg bw (males) and 2830 mg/kg bw (females).

--The acute inhalation LC^{50} for rats is ~1200 mg/m^3 (males) and ~800 mg/m^3 (females).

--Fenthion is moderately toxic (Toxicity Category II) by the oral, dermal and inhalation routes of exposure.

--Fenthion is minimally irritating (Toxicity Category IV) to the skin and eyes.

--Fenthion is not teratogenic in rabbits.

--The fetotoxic NOEL in the rabbit is 1 mg/kg/day.

--The maternal toxicity NOEL in the rabbit is 6 mg/kg/day.

--The teratogenic NOEL in the rabbit is $\geq$18 mg/kg/day.

--Fenthion is non-mutagenic in male mice up to 25 mg/kg bw (the highest dose tested).

--Fenthion's systemic NOEL for mutagenicity is 10 mg/kg bw.

Environmental Characteristics

--Available data are insufficient to fully assess the environmental fate and transport of fenthion. (Data gaps exist for nearly all applicable studies.)

--The available data indicate that fenthion degrades fairly rapidly, with a half-life of less than a day reported in nonsterile silt loam soil in the dark at 75% moisture and room temperature.

--Data also suggest that fenthion degrades to 53% under anaerobic conditions after 60 days incubation.

--The major nonvolatile degradates reported were fenthion sulfoxide, 3-methyl-4(methylsulfonyl) phenol, and 3-methyl-4(methylsulfinyl) phenol.

--Data currently available are insufficient to characterize fenthion's leaching potential for contamination of ground water. (Data to characterize the potential to contaminate groundwater are being required.)

Ecological Characteristics

Avian acute toxicity: Acute toxicity values of 5.94 mg/kg in the mallard duck, < 4.0 mg/kg in the bobwhite quail, and 2.50 mg/kg in doves.

Avian dietary toxicity: Subacute dietary toxicity values ranged from 30 ppm in the bobwhite quail to 231 ppm in the mallard duck. The potential for secondary toxicity was demonstrated when kestrels died after being fed house sparrows that had been killed by an oral dose of 10 mg/kg fenthion.

Freshwater fish acute toxicity: 96-hour acute toxicity values ranged from 3.20 ppm for fathead minnows to 1.58 ppm for cutthroat trout.

Marine fish acute toxicity: LC_{50} value of 1.6 ppb for striped mullet.

Freshwater invertebrate toxicity: The acute toxicity values ranged from 0.62 ppb for Simocephalus (Daphnid) to 0.80 ppb for Daphnia pulex.

Marine invertebrate toxicity: EC_{50} value of 340 ppb for mollusks; 96-hour LC_{50} value of 0.11 ppb for pink shrimp.

These data show that technical fenthion is very highly toxic to birds on an acute oral and dietary basis; moderately to highly toxic to both warmwater and coldwater fish species; very highly toxic to aquatic invertebrates; very highly toxic to pink shrimp; moderately toxic to striped mullet; and highly toxic to mollusks.

TOLERANCE REASSESSMENT

Tolerances have been established for residues of fenthion and its cholinesterase inhibiting metabolites in a variety of raw agricultural commodities (40 CFR 180.214). The Agency has evaluated the residue and toxicology data supporting these tolerances and has determined that it does not have sufficient data to support the currently established tolerances for residues of fenthion. Because of the extensive residue chemistry and toxicology data gaps, no significant new tolerances or new food uses will be granted until the Agency has received data sufficient to evaluate the dietary exposure to fenthion.

In addition to United States tolerances, there are also Canadian tolerances, Mexican tolerances, and Codex Maximum Residue Limits (MRLs) established for fenthion. However, some incompatibility exists between some of the permanent Codex MRLs and the U.S. tolerances. The issue of incompatibility will be addressed when residue data are submitted and evaluated.

The available toxicity data are insufficient for the Agency to calculate an Acceptable Daily Intake (ADI) for fenthion and therefore the Maximum Permissible Intake (MPI) for a 60 kg human has not been determined.

5. REQUIRED UNIQUE LABELING SUMMARY

Personal protective equipment and work safety statements must appear on the label of all registered end use products containing fenthion.

All end-use products containing fenthion as an active ingredient with directions for use on agricultural crops, ornamental plants and forest trees, uncultivated agricultural and non-agricultural outdoor areas, aquatic sites, livestock and bird roosting areas must bear the following restricted use labeling statements:

"RESTRICTED USE PESTICIDE

Due to Very High Acute Toxicity to Birds, Fish and Aquatic Invertebrates

For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certified applicator's certification. Certified applicators must also ensure that all persons involved in these activities are informed of the precautionary statements."

Environmental hazard statements and a bee precautionary statement must appear on the label of all end-use fenthion products.

The following reentry interval statement and protective clothing for early reentry statement must appear on the labeling of all fenthion products labeled for use on ornamentals:

"Reentry into treated area is prohibited for 24 hours (1 day) after the end of application, unless the protective clothing specified on this label for early reentry is worn.

FOR EARLY REENTRY INTO TREATED AREAS BEFORE SPRAYS HAVE DRIED [OR DUST HAS SETTLED, as applicable] wear all protective clothing specified on this label for an applicator.

FOR EARLY REENTRY INTO TREATED AREAS AFTER SPRAYS HAVE DRIED [OR DUST HAS SETTLED, as applicable] wear protective suit of one or two pieces covering all parts of the body except head, hands, and feet; chemical-resistant gloves; chemical-resistant shoes (or chemical-resistant shoe covers or chemical-resistant boots).

6. REGULATORY POSITION SUMMARY

The Agency will not grant any tolerances for significant new food uses[2] until sufficient data (residue chemistry and toxicology) are submitted for the Agency to calculate an Acceptable Daily Intake (ADI) for fenthion.

The Agency is classifying all fenthion end-use products with directions for use on agricultural crops, ornamental plants and forest trees, uncultivated agricultural and non-agricultural outdoor areas, aquatic sites, livestock and bird roosting areas as Restricted Use pesticides, based on avian, fish and aquatic invertebrate toxicity.

The Agency is establishing an interim 24-hour reentry interval for the use of fenthion on ornamentals until adequate data have been submitted and evaluated.

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[2]"New use" is defined in 40 CFR 152.3(p). In the case of a new food or feed use, the Agency will generally consider as significant an increase in the Theoretical Maximum Residue Contribution (TMRC) of greater than 1%.

The Agency is requiring special studies, in rodent and nonrodent species, on the effects of fenthion on the eye.

The U.S. Fish and Wildlife Service (FWS) has determined that certain uses of fenthion may jeopardize the continued existence of endangered species or critical habitat of certain endangered species. EPA is developing a program to reduce or eliminate exposure to these species to a point where use does not result in jeopardy, and will issue notice of any necessary labeling revisions when the program is developed. No additional endangered species labeling is being required at this time.
A feed additive tolerance must be proposed for residues of fenthion and its cholinesterase-inhibiting metabolites in rice hulls.

While data gaps are being filled, currently registered manufacturing use products and end use products containing fenthion may be sold, distributed, formulated, and used, subject to the terms and conditions specified in the Registration Standard for Fenthion. Registrants must provide or agree to develop additional data in order to maintain existing registrations.

7. Summary of Major Data Gaps

Toxicology

Dermal Sensitization
Acute Delayed Neurotoxicity
Subchronic 90-Day Feeding, two species (rodent and nonrodent)
Chronic Toxicity, two species (rodent and nonrodent)
Oncogenicity, two species
Teratogenicity (rat)
Reproduction

Environmental Fate/Exposure

Hydrolysis
Photodegradation, water
Photodegradation, soil
Photodegradation, air
Anaerobic Aquatic Metabolism
Aerobic Aquatic Metabolism
Leaching and Adsorption/Desorption
Volatility, laboratory
Volatility, field (based on results of the laboratory volatility study)
Terrestrial Field Dissipation
Aquatic Field Dissipation
Forestry Dissipation
Soil Dissipation, long term (based on the results of the Terrestrial, Forestry and Aquatic Field Dissipation studies)
Confined Accumulation, rotational crops
Field Accumulation, rotational crops (may be required depending on results of acceptable confined rotational crop accumulation data)
Accumulation, irrigated crops

Fish Accumulation, laboratory (registrant should first submit an Octanol/ water Partition Coefficient)
Field Accumulation, aquatic nontarget organisms (may be required depending on the results of laboratory accumulation study)
Foliar Dissipation
Droplet Size Spectrum
Drift Field Evaluation

Ecological effects

Avian Acute Oral (for Degradates)
Avian Subacute Dietary (for Degradates) (upland game bird and waterfowl
Wild Mammal Toxicity (for Technical Grade and Degradates)
Avian Reproduction (upland game bird and waterfowl)
Simulated and Actual Field Testing for mammals and birds
Freshwater Fish LC_{50} (for Degradates) (warmwater and coldwater species)
Freshwater Invertebrate LC_{50} (typical end-use product)
Estuarine and Marine Organisms LC_{50} (Technical Grade and typical end-use product)
Aquatic Organism Accumulation
Simulated or Actual Field Testing (Aquatic organisms)
Honeybee - Toxicity of Residues on Foliage
Special Tests -
-(Residue Monitoring in Water and on Animals)
-(Bivalve Toxicity)
-(Reptile and Amphibian Toxicity)

Residue Chemistry

Nature of Residues (Metabolism [Plants, and Livestock])
Residue Analytical Methods
Residue Storage Stability
Magnitude of Residues in Plants

Product Chemistry

All Product Chemistry Studies

8. CONTACT PERSON AT EPA

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DISCLAIMER: The information in this Pesticide Fact Sheet is a summary only and may not be used to fulfill data requirements for pesticide registration and reregistration. The complete Registration Standard for the pesticide is available from the National Technical Information Service. Contact the Product Manager listed above for further information.